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US 4004150 A

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(54) Medical sample examination module

(57) A medical sample examination module is designed to fit in a casing suitable for insertion into the spare disc drive slot of a P.C. The module may comprise a microplate support arrangement 17 capable of receiving and supporting at least one transparent microplate 6 apparatus capable of moving an inserted microplate through the casing, at least one row of light-emitting devices (8, Fig 4 not shown) with the same spacing as the wells of each row in a microplate located within a rotatable drum (9), a row of photoelectric cells (19) arranged above the microplate support arrangement, the spacing of the photoelectric cells being the same as the spacing of the wells of each row of a microplate and each cell being in line with a light-emitting device and being connectable to an appropriate information-processing unit in a computer. The rotateable drum (9) has three apertures two of which are covered in filters. The drum is rotated to bring each aperture inbetween the light sources and the detectors thus allowing analysis of the samples at two separate frequencies. The third aperture is clear to act as a control.

PLAN VIEW

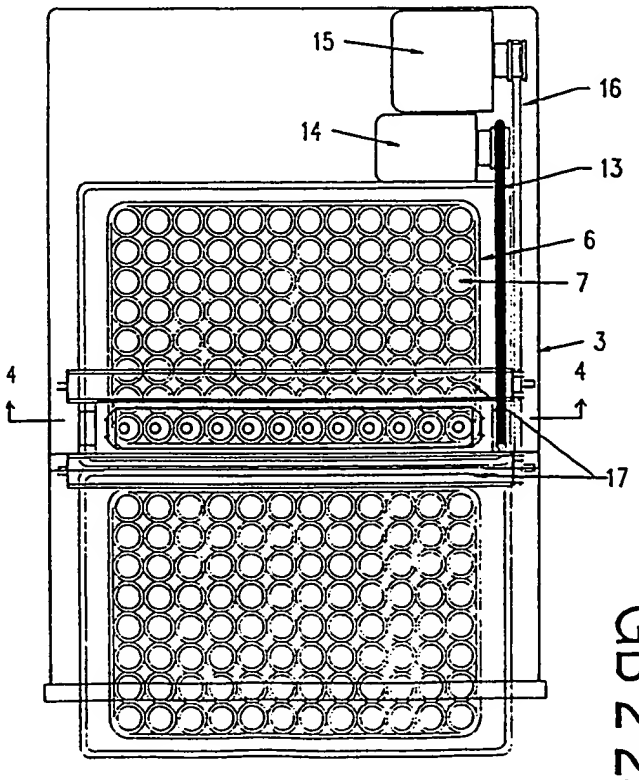

FIG 3

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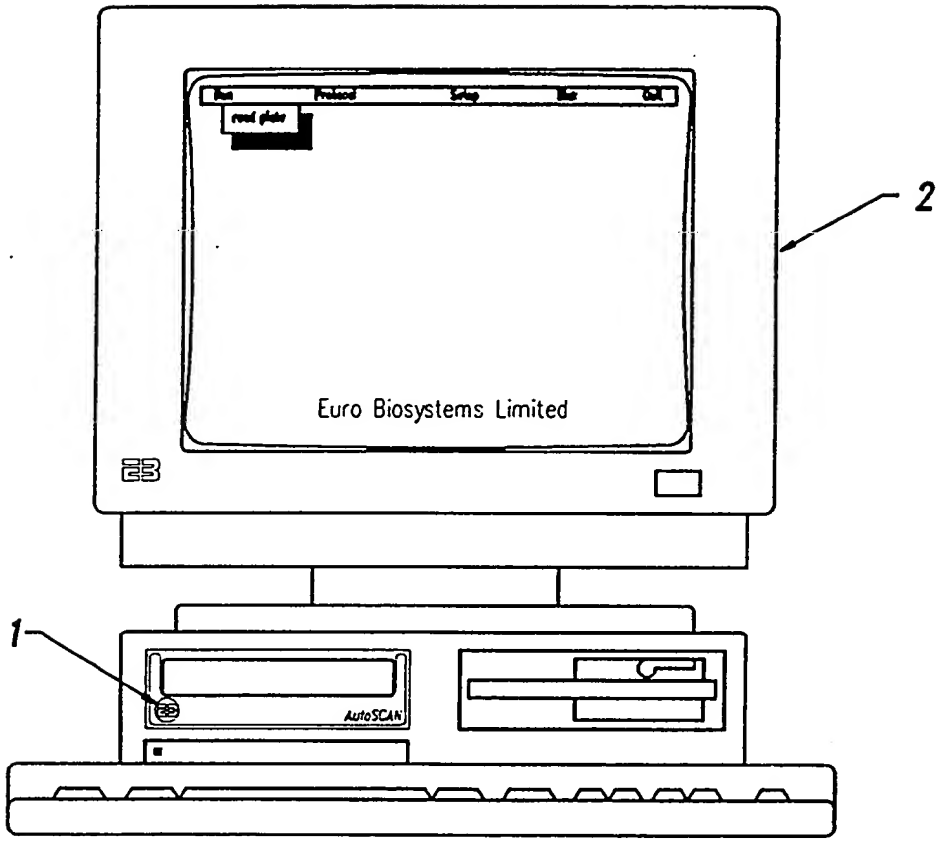


FIG 1

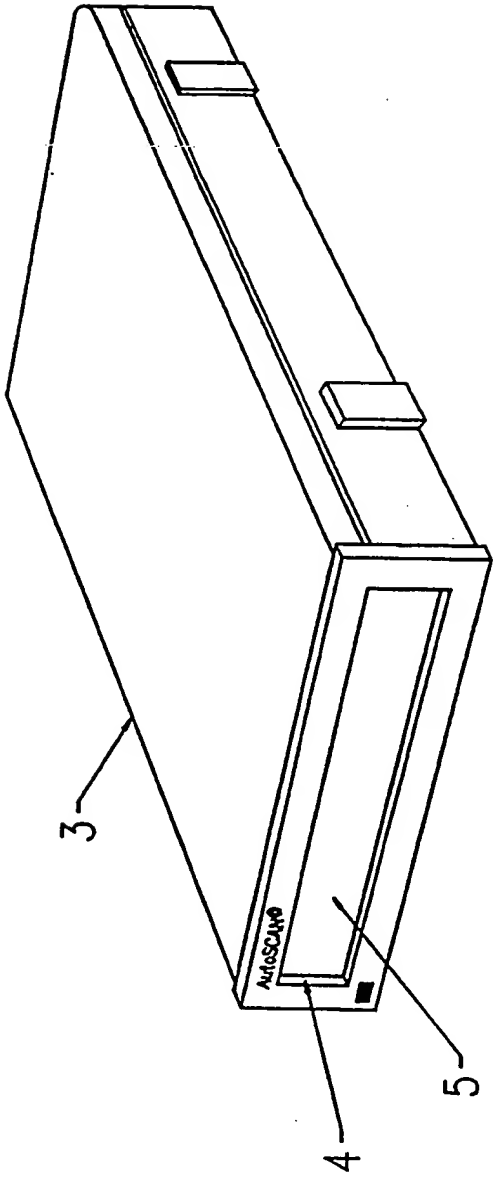
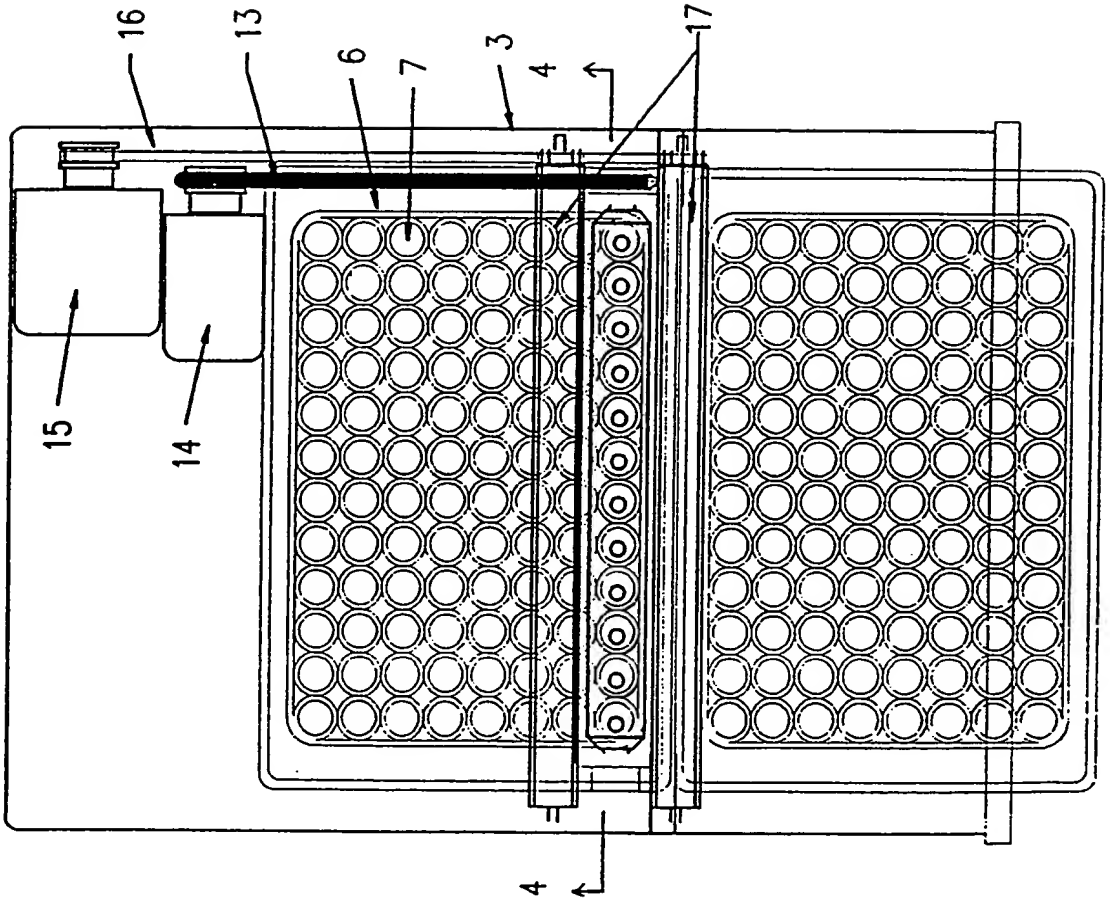
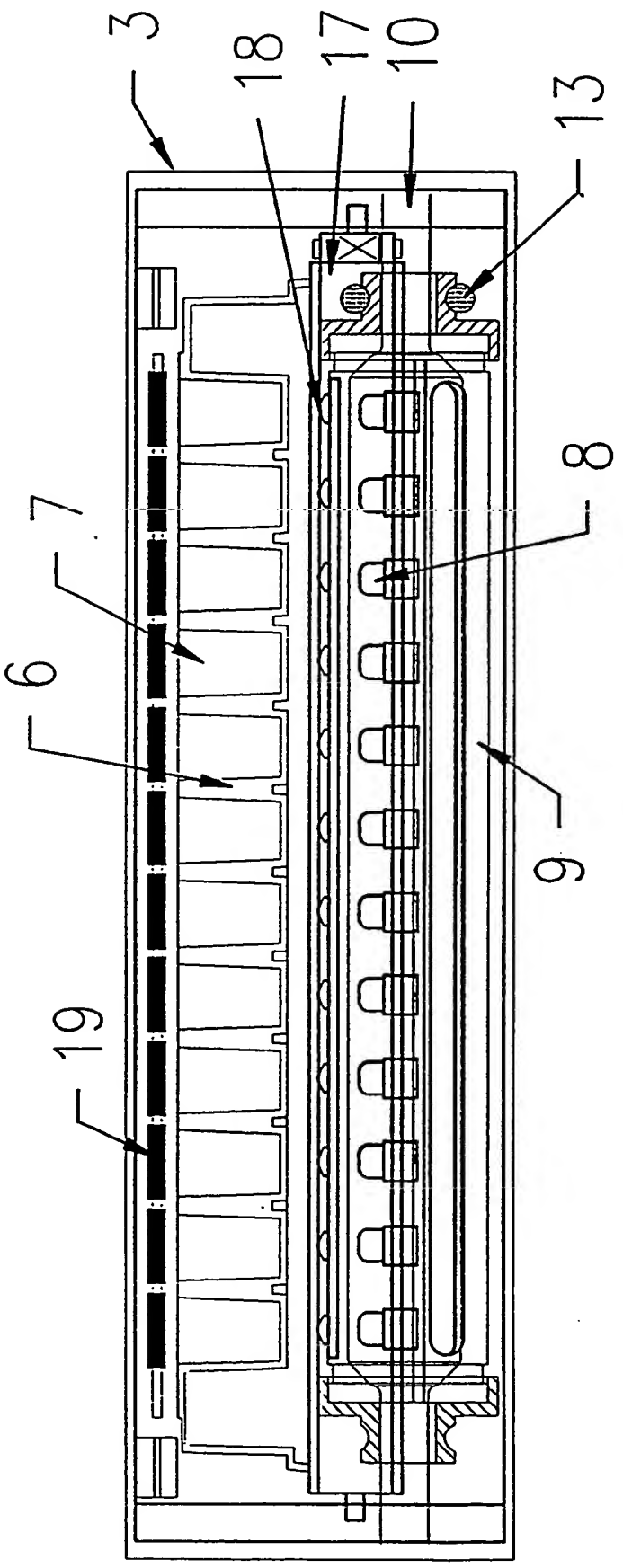


FIG 2



PLAN VIEW

FIG 3



FRONT VIEW

FIG 4

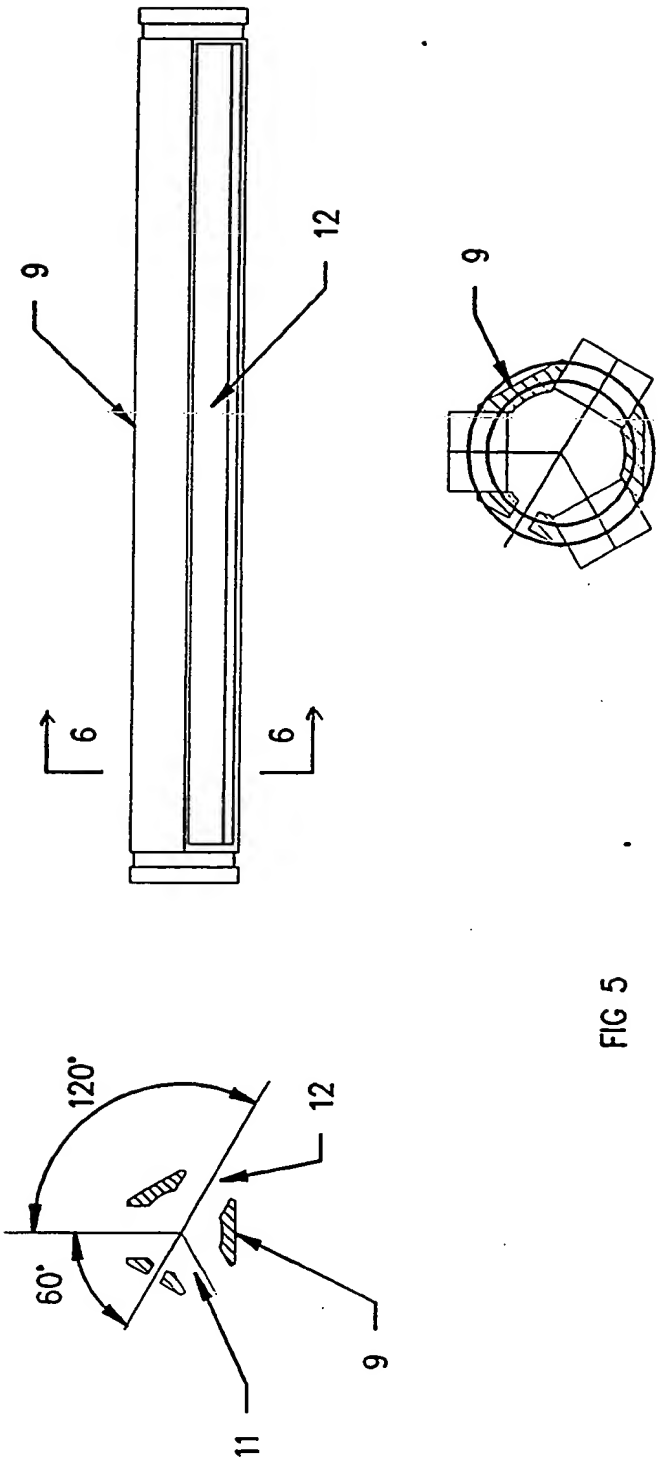


FIG 5

MEDICAL SAMPLE EXAMINATION MODULE

The subject of this invention is a module for facilitating the examination of liquid samples, for example, samples of human body fluids.

It is customary practice in certain forms of diagnosis to examine samples of a particular body fluid of a patient at a series of different dilutions and at several wavelengths, usually three, of light traversing the samples.

At present such an examination is performed as a series of separate actions.

For example to obtain information about the quantity of fibrinogen degradation products present in the blood of a patient suffering from disseminated intravascular coagulation a quantity of the blood of the patient is divided into separate samples which are individually diluted to different concentrations, and held conveniently in adjacent compartments in a monoplate. The diluents may be buffer solutions or antigens. A beam of light is directed down through each sample in turn and for convenience the image is reflected in a mirror to the observer. The concentration at which the cell buttons have started to separate out is noted and appropriate calculations made to obtain definite figures for the actual level of fibrinogen degradation products

in the patient's blood. As it is not always very clear in which of the samples the cell buttons have just begun to disintegrate it is quite common for several different observers to be called to examine the samples to obtain agreement.

To obtain readings of chosen constituents of blood, for example, the same form of examination is carried out and with light of different wavelengths, the results being collated to give the required information. In the case of blood this can provide information relating to measurements of the quantity of plasma haemoglobin and metahaemalbumin. This form of testing is important in haemolysis.

It will be understood that the process described is extremely time consuming and is not completely accurate as it depends particularly in DIC testing to a large extent on the judgement of the operator.

It is an object of the present invention to provide an apparatus for making it possible to perform a fast examination of the body fluids from a number of patients, in quick succession, with certainty of patient identification, with high accuracy of examination without any necessity to make a series of individual personal assessments and calculations and using an inexpensive

personal computer such as is found in most medical laboratories.

A medical sample examination module according to the invention is characterized by comprising a casing incorporating a microplate support arrangement capable of receiving and supporting at least one transparent microplate of the well-known type containing parallel rows of individual wells each of which is capable of holding a sample of a fluid to be examined, apparatus capable of moving an inserted microplate through the casing, at least one row of light-emitting devices disposed to be parallel to the rows of wells in a microplate inserted in the module and below the wells in said microplate, the spacing of the light-emitting devices being the same as the spacing of the wells of each row in a microplate so that each such well of a microplate can be directly above a light-emitting device, a hollow rotatable drum of opaque material enclosing the light-emitting devices and the wall of which is formed with at least one longitudinal slot, a row of photoelectric cells arranged above the microplate support arrangement, the spacing of the photoelectric cells being the same as the spacing of the wells of each row of a microplate and each photoelectric cell being in line with a light-emitting device and being connectible into an appropriate information-processing unit in a computer,

drum-rotating means and control means arranged to be set in operation by insertion of a microplate into the support arrangement to bring each row of wells of the microplate in successive steps between the row of light-emitting devices and the row of photoelectric cells, rotate the roller to bring successive slots in the roller into line with the light-emitting devices, activate the light-emitting devices and when the last row of wells in the microplate has been examined eject the microplate.

A light-focussing lens associated with each light-emitting device may be provided in the casing, the lenses being arranged to focus the light from the light-emitting devices on the bottoms of the wells in a microplate fitted to the module.

The roller may be formed with one slot arranged to provide unrestricted passage of light therethrough and at least one slot fitted with a filter formed to permit passage of light of a particular wavelength. It is customary to examine fluid samples at three different wavelengths and in that case the roller will be formed with four slots, one clear and the remaining three each bearing a filter formed to permit passage of light of one of the particular three wavelengths. The roller may of course be formed

to carry filters of as many wavelengths as are desired.

The module casing may be formed of dimensions such as to permit the casing to fit into the spare disc drive slot provided in most personal computers. The dimensions may be chosen to suit a particular make of computer although most computers have disc drive slots of the same dimensions.

The information processing unit may be in the form of a circuit board incorporated in the casing with a plug-in extension for connection to the electronic circuit of a computer. Alternatively the information processing unit may be a separate unit arranged to plug into a socket in the casing and a socket in a computer.

The microplate support arrangement may be combined with the apparatus for moving the microplate and may comprise rotatable rollers on which an inserted microplate will rest. There may be provided electrical, optical or mechanical detecting means operable to detect when a microplate is inserted in the casing to set the rollers in motion and feed the microplate into the casing to the position ready for examination of the liquid contained in the first row of wells.

A practical embodiment of the invention is illustrated in the accompanying semi-diagrammatic drawings in which Fig. 1 illustrates the type of personal computer suitable for use with the module of the invention, Fig. 2 illustrates a module of the invention, Fig. 3 is a plan view of the module of Fig. 2 with the top cover removed, Fig. 4 is a section through the line 4-4 in Fig. 3, Fig. 5 illustrates the slotted drum fitted with light filters and Fig. 6 is a section through the line 6-6 in Fig. 5.

In the drawings, the personal computer as illustrated in Fig. 1 is customarily formed with a spare disc drive slot 1 for entry of a floppy disc, the screen 2 serving to display the results of the examination of the liquid samples in a microplate contained in a module of the invention inserted into the slot 1. 3 (Fig. 2) denotes the casing of a module of the invention formed with an entry slot 4 covered normally by a flap 5. 6 denotes a microplate held within the casing 3, the microplate 6 being formed with wells 7 arranged in parallel rows. 8 denotes light bulbs constituting the light-emitting devices located within a drum 9 rotatable on stub axles 10. The drum 9 is formed with longitudinal slots one of which 11 is an open slot and the others of which 12 are covered with light filters each of which is

formed to pass light of a specific wavelength. The drum 9 is rotatable by a driving band 13 arranged to be driven by an electric motor 14. 15 denotes an electric motor drivingly coupled by a driving band 16 to driving rollers 17 arranged to support a microplate insert into the the module. 18 denotes lenses arranged to focus light from the light bulbs 8 on the bottoms of the wells 7 in the microplate 6. 19 denotes photoelectric cells arranged in a row above the microplate 3 and spaced so that each cell is above a respective well 7 in the microplate 3. The appropriate control means, conveniently in the form of a circuit board is not illustrated since there need be nothing novel in its construction and its design is well within the abilities of any competent electronics engineer.

In practice, the module is inserted into the disc slot 1 of a personal computer, then a microplate 6 containing in its wells 7 samples of the liquid to be examined is inserted in the module. This activates the means to draw in the plate 6, close the plate entry slot 4 and move the plate to the position where the first row of wells 7 is over the row of light-emitting devices 8 and the hollow drum 9 is positioned with the open slot 11, i.e. the slot not fitted with a filter, in place between the light-emitting devices 8 and the first row of wells 7. The light-

emitting devices 8 are activated, the light from each light-emitting device 8 passes without attenuation and focussed by the associated lens 18 up through the liquid in the well 7 immediately above and enters the photoelectric cell 19 directly above. The signal from each photoelectric cell 19 is conveyed to the computer which is programmed to make the appropriate analysis and display the results on the screen 2 as control results. The hollow drum 9 then rotates automatically to bring a slot 12 fitted with a filter into place so that light from each light-emitting device 8 passes through the filter before passing through the liquid in the respective well 7 and then to the respective cell 19. The signal from each well 7 is analysed and displayed on the screen 2 as results obtained at the wavelength of that particular filter. This operation is repeated in turn for each filter.

When the first row of wells in the microplate has been treated in that fashion the microplate 6 is moved automatically to bring the next row of wells 7 above the light-emitting devices 8 and rotate the drum 9 to the starting position. The same operation is repeated for said next row of wells 7.

After all the wells have been read the microplate is automatically ejected.

The information appearing on the screen can be transferred to a store such as a floppy disc for future reference.

The module can be used without inserting it into a computer by providing a cable link from the module to a computer.

CLAIMS.

1 A medical sample examination module comprising a casing (3 of figure 2), which may be formed to dimensions such as to permit the casing to fit into the spare disc drive slot (1 of figure 1) provided in most personal computers.

2 A medical sample examination module as claimed in Claim 1 wherein there are light emmiting devices (8 of figure 4) located within a rotatable drum of opaque material (9 of figure 4 and figure 5) allowing the selection of light filters each of which is formed to pass light of a specific wavelength.

3 A medical sample examination module as claimed in Claim 1 wherein means are provided to guide and move an inserted microplate over the rotatable drum without the use of a carrier device. (Figure 3).

4. A medical sample examination module as described herein with reference to figures 1-5 of the accompanying drawings.

Patents Act 1977
Examiner's report to the Comptroller under Section 17 (The Search Report)

Application number
9113083.1

Relevant Technical fields

(i) UK Cl (Edition K) G1A (ARV, ARP)

(ii) Int CL (Edition 5) G01N

Search Examiner
J M MCCANN

Databases (see over)

(i) UK Patent Office

(ii) ONLINE : WPI

Date of Search
12 AUGUST 1992

Documents considered relevant following a search in respect of claims 1

Category (see over)	Identity of document and relevant passages	Relevant to claim(s)
A	US 4004150 (NATELSON) - whole document especially figure 1	1

Category	Identity of document and relevant passages	Relevant to claim(s)

Categories of documents

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